Sub-Orbital Scale variations in the Intensity of the Arabian Sea Monsoon

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Thesis submitted for the degree of
Doctor of Philosophy
University of Edinburgh
2004

For Paul

I attest that:

All material presented in this document was compiled and written by myself unless otherwise acknowledged.

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Acknowledgements:

I would like to extend sincere thanks to Raja Ganeshram, who was an inspiring supervisor, and to Sandy Tudhope, Steve Calvert and Brian Price who contributed significantly to this work as mentors and critics. The technical staff at the University of Edinburgh, Dodie James, Colin Chilcott, Ann Menim and Geoff Angel provided indispensable help throughout my time in Edinburgh. This work was reliant on the foresight and generosity of Gert-Yan Brummer, Gerald Ganssen and Michel Fontugne who provided the core samples that this work is based on. The University of Edinburgh provided me with an Overseas Research Scholarship and a Faculty of Science Scholarship that made this work possible, I am truly grateful.

Thanks to Steve Moreton at the AMS lab in East Kilbride for assisting with the ^{14}C dating and to Rob Ellam and Valerie Olive at SUERC who were critical in the beginning stages of this project. Stuart Hazeldine was a great advisor, who I thankfully did not have to call upon too often. Finally, I am grateful to Mary Elliot and Dick Kroon whose comments improved this work. I hope to have a chance to work with you all again.

I would also like to acknowledge Kenny M^{c}Brearty, Matt Harrison, and Matt Schwartz, who made my time in Edinburgh unforgettable. I look forward to meeting up with all again, where ever we can. Finally, I would like to thank Paul for his continual support and willingness to indulge my whims.

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Abstract

A high-resolution multi-proxy reconstruction of the Arabian Sea Summer Monsoon (ASSM) intensity over the past 90,000 years has been determined using two marine sediment cores: one from the Somali margin and one from the Indian margin. This reconstruction indicates that changes in monsoon- induced upwelling, primary productivity and denitrification have varied in synchrony with Dansgaard-Oeschger (D-O) cycles. Increased monsoon intensity correlates with warm climate events (interstadials) and decreased monsoon intensity, which coincides with stadials and Heinrich Events, is confirmed by elevated dust concentrations in the marine cores.

A comparison of the Somali and Indian margin cores with previously reported studies from the Northern and Western Basin allows the identification of discrete sediment signals from the Indus River, the Arabian Peninsula and from local riverine runoff. Sedimentary deposition on the Indian margin during interglacials is dominated by local terrestrial runoff, whereas during glacial periods increased dust input from the Arabian Peninsula is evident. Both signals are related to changes in the intensity of the ASSM.

Monsoon intensity has decreased during the Holocene as the Intertropical Convergence Zone (ITCZ) has moved to a more southerly position. The ASSM-ITCZ relationship (increased ASSM intensity and a northern ITCZ, decreased ASSM intensity and a southern ITCZ) has remained consistent over the last glacial cycle suggesting that global millennial scale climatic variability is in part driven by modulations in tropical hydrological cycle. This ASSM reconstruction provides evidence that rearrangements in the tropical convection system affected atmospheric dust concentrations as well as the concentration and location of atmospheric water vapour. In addition to modulating terrestrial and marine emissions of greenhouse gases, variation in the tropical hydrological cycle provides a mechanism of amplifying and perpetuating millennial-scale climatic changes.

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